THE CARTOGRAPHIC EVALUATION OF ERTS ORBIT AND ATTITUDE DATA

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Washington, D.C. 20242

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16. Abstract

Without the required RBV images; increased attention has been directed toward evaluating the geometric quality of MSS images. A line scan anomaly was identified and analyzed. Successive generations of images have been checked for variations in geometric distortion; it has been consistent. Some recent MSS images have about 250 m rms of relative positional accuracy although earlier images were generally over 300 m. Efforts are continuing to isolate systematic errors in MSS images but present results are inconclusive.

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Figure 2. Technical Report Standard Title Page

Type II Progress Report
ERTS 1

a. Title: Cartographic Evaluation of ERTS Orbit and Attitude Data

ERTS 1 Proposal No.: SR 150

b. GSFC ID No. of P.I.: IN043

c. Problems:

1. The continued lack of RBV images is causing considerable difficulty in pursuing the concepts of the investigation outlined in the proposal.

c. Accomplishments:

1. Without RBV images, increased attention is being given to the geometric quality of MSS images.
2. An anomaly of the line scan pattern was identified and analyzed. It is described in the appendix to this report.
3. One MSS scene (1080-15192, Washington, D.C.) was obtained as a first generation copy. Ground control points in bands 4 and 7 were measured and compared in a linear transformation against UTM coordinates. The standard error of position was 234 m for band 4 and 253 m for band 7. These values are lower than previous scenes which had all exceeded 300 m.
4. Some additional first generation 70 mm images were obtained. The measurements were compared against third generation images of the same scene. The results show only minor differences of a few meters. Therefore there is no identifiable loss of geometric quality during processing and reproduction of 70 mm images.

5. A series of test sites have been selected for measurement tests of MSS and RBV images. A list is attached.
6. Efforts are continuing to isolate systematic errors in the MSS images but nothing can be reported at the present time.
7. The reseau on six RBV tubes have been calibrated in cooperation with RCA. These are candidate tubes for the ERTS B mission.

e. Published articles and reports: None

f. Recommended changes in operations:

1. If the RBV cameras continue inoperative, a formal modification should be incorporated in the contract to allow use of the MSS images for slightly different objectives. This should be done at the end of the next reporting period, 28 February 1973.

g. Changes in Standing Order Forms: None

h. ERTS Image Descriptor Forms: None

i. Changes in Data Request Forms: None

j. DCP Status: N/A

GEOMETRIC TEST SITES

Exeter, N.H.	43° N	71° W
Washington, D.C.	39° N	77° W
Orlando, Fla.	28° 30' N	81° 30' W
St. Cloud, Minn.	45° 30' N	94° 30' W
Ft. Huachuca, Ariz.	31° 30' N	110° 30' W
San Francisco, Calif.	37° 30' N	122° 30' W

Robert Vaguine

United States Department of the Interior

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GEOLOGICAL SURVEY
WASHINGTON, D.C. 20242

November 27, 1972

Memorandum for the Record (EC-11-ERTS)

From: Chief, Remote Sensors Section

Subject: MSS Scan Line Anomaly

The enclosed drawing is an outline of part of the San Francisco peninsula, the Golden Gate Bridge, and Marin County. The San Francisco Oakland Bay Bridge between the city and Yerba Buena Island also appears. The outline was traced directly from an enlarged transparency (copy enclosed) of ERTS-1, frame 1021-18172, MSS-6. The scale is approximately 1:100,000. The spacecraft heading and MSS scan direction are shown with the scan lines intersecting the Golden Gate bridge axis at an angle of 73°.

The anomaly of interest is the stair-step pattern of the bridge. Each cycle is approximately 474 m in length corresponding to the coverage of six contiguous scan lines. The step over between cycles is approximately 160 m and is a function of both the bridge-scan angle (73°) and the processing anomaly.

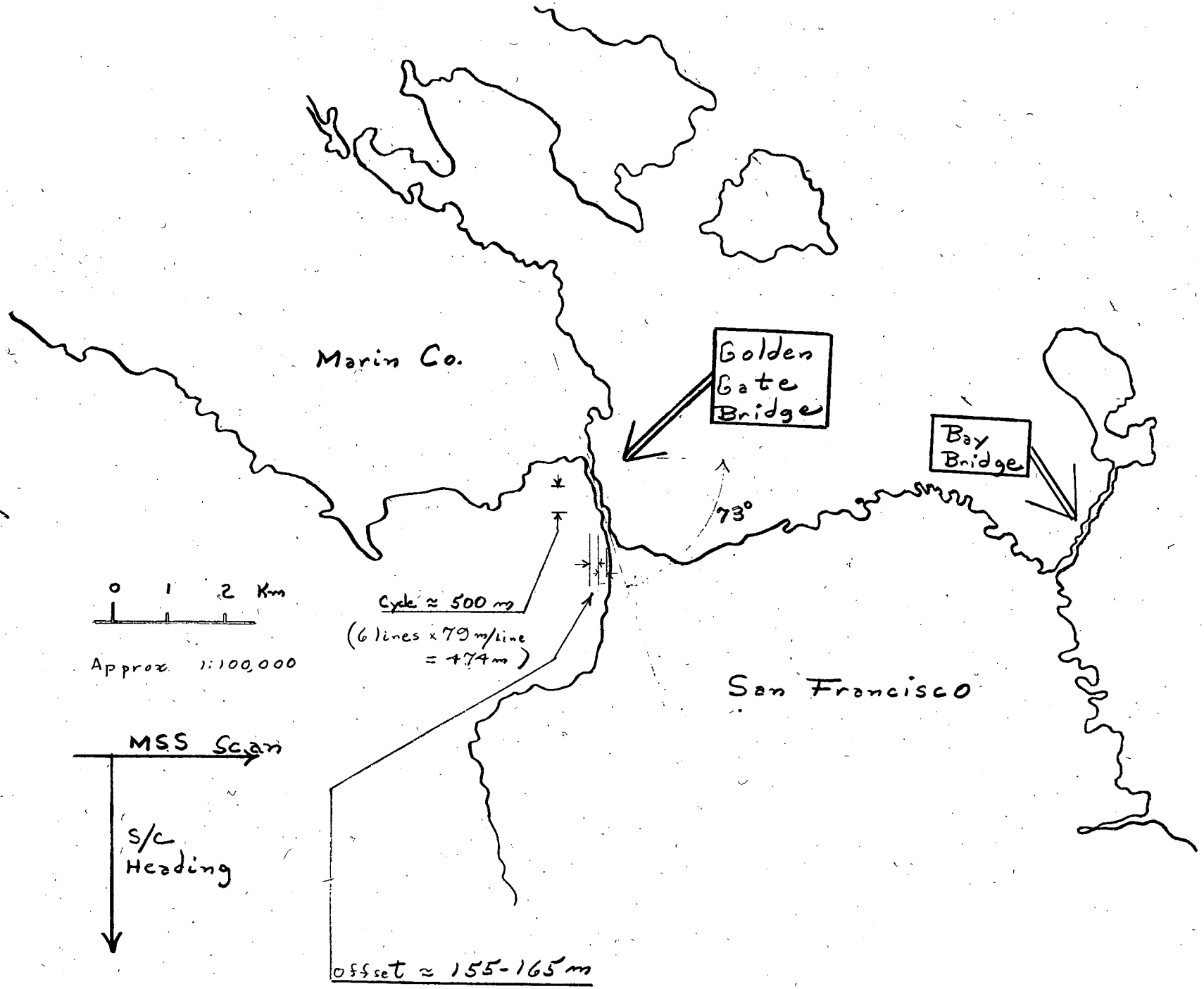
It appears that all six scan lines from each mirror cycle are being merged about an average position during printing of system corrected (bulk) images. For this particular case, the position error of a point on the bridge could be 80 m in error from the mean position; measurement of two adjacent points or the same point on different orbits could have relative errors of 160 m.

An interpreter can mentally average a linear feature such as the bridge; however, the same anomaly will occur for all images and can not be readily discerned. Resolution, cartographic positioning, automatic data processing, and temporal change detection will be adversely affected. The anomaly has been traced to a characteristic of MSS data processing and separate from other spacecraft and scanner distortions.

Measurements were also made of the bridge width. Based on an average of 12 measurements, the image gives a width of 149 m. The Golden Gate Bridge Authority provided a dimension of 90 feet (27.4 m) rail-to-rail. Some of the difference may be attributed to the photographic enlarging process but the magnitude of potential error is apparent.

Robert B. McEwen

Enclosures 2


Marin Co.
Golden Gate Bridge
Bay Bridge
73°
San Francisco
0 1 2 Kms
Approx 1:100,000
Cycle ≈ 500 m
(6 lines x 79 m/line = 474 m)
MSS Scan
S/C Heading
offset ≈ 155-165 m